Vernier

College Edition

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THE Caliper NEWSLETTER

Celebrating Dave Vernier's 50 Years in Education

Dave Vernier's bridge-building contest in 1981

This fall will mark Dave Vernier's 50th year in education. From starting his career as a physics teacher, first at an inner-city school in Cleveland and later in Oregon, to ultimately co-founding Vernier Software & Technology, science education and technology have always been passions for Dave.

Over the past 38 years, Vernier Software & Technology has supported thousands of science educators through the use of reliable hands-on technology. We asked Dave about science education and the changes he's seen in edtech over his years in the business.

Q 50 years is a long time in education. During that time, how did the use of technology in schools get started? How has it changed and evolved?

A When I started teaching, there was not very much of what you would call "technology" being used. Thankfully, there is a lot more and better-quality equipment now.

During my teaching, I loved to do experiments, and the students did a good job taking data, but then they had to graph the data by hand on paper. This often took them a long time to complete. By the time they had the graph completed, they saw very little connection between the graph and the experiment they had done 15 minutes earlier. It was just "busy work" to them. Having a computer graph the data as they are taken makes all the difference in having students understand graphs.

The computer speeds up every aspect of the experimental process—the data collection, the graphing, the data analysis, and even the write-up. Now, students can do an experiment and repeat it with varying conditions to look for patterns, as well as even design their own experiments.

To learn more about Dave's experience, visit **www.vernier.com/r199**

Dave Vernier demonstrates Go Direct® support with Raspberry Pi

Applications Open for Annual Vernier/NSTA Technology Awards

Vernier Software & Technology and the National Science Teaching Association (NSTA) are now accepting applications for the annual Vernier/NSTA Technology Awards. The 2020 awards program will recognize K–college educators who promote the innovative use of data-collection technology.

For more information about the award and to read about this year's winners, visit **www.vernier.com/grants**

Exploring Moments of Inertia with a Centripetal Force Apparatus

Add another layer to your investigation of rotational motion by integrating this activity designed for advanced high school and college physics.

The Centripetal Force Apparatus Moment of Inertia Accessory Kit is an excellent tool to expand the range of experiments and investigations with the Centripetal Force Apparatus or the Go Direct® Centripetal Force Apparatus. This accessory kit includes objects that can attach in different configurations to explore how the distribution of mass affects angular acceleration. It includes a ring and two disks, in addition to the beam that is included with our centripetal force apparatus.

We have created an activity for students to determine the moment of inertia of the various mass configurations.

The initial slope of the angular velocity is used to determine angular acceleration.

The Moment of Inertia experiment provides instructions for setting up the equipment and then collecting and analyzing data. Students are guided through pre-lab activities designed to develop conceptual understanding that students use to make predictions. After conducting their investigations, the students compare the theoretical moments of inertia to their experimental values.

Download the free experiment at **www.vernier.com/r1910**

Go Direct Centripetal Force Apparatus

NEW Go Direct Spirometer

Use our new Go Direct Spirometer to wirelessly record human respiratory flow rate and volume. Students can measure ventilation (the movement of air in and out of the lungs during inhalation and exhalation) while connecting this sensor to a variety of devices via USB or Bluetooth® wireless technology. The wireless capabilities minimize cables getting tangled during human physiology experiments.

As a multi-channel sensor, Go Direct Spirometer can also measure air pressure and respiration rate. With built-in baseline correction, this human physiology sensor makes spirometry a breeze.

You can find free experiments and learn more about Go Direct Spirometer at **www.vernier.com/gdx-spr**

Physical Computing with Raspberry Pi and Go Direct Sensors

Over the last few months, we have been testing the Vernier Python module for Go Direct sensors on Raspberry Pi. Raspberry Pi is an affordable, fully functioning computer that was developed and built to help encourage the understanding, learning, and continued study of computing in schools.

When given Go Direct sensors and Python® as tools, students can integrate their coding skills with data-collection projects to visualize data or incorporate sensor data with a Raspberry Pi.

To learn more about our support of Raspberry Pi, visit **www.vernier.com/r1911**

Science Humor

Since we are celebrating the 150th anniversary of the Periodic Table, Dave Vernier went through more than 30 years of newsletters to pull out the best humor. We have used chemistry jokes periodically in other issues.

What do you do with a sick chemist?

If you can't 

or 

then you 

Chemist's laughing gas:

Follow @VernierST on Twitter

NEW Go Direct Blood Pressure

Record blood pressure parameters on a Chromebook™, or any compatible device, with our new Go Direct Blood Pressure. This versatile human physiology sensor connects to a variety of devices via USB or Bluetooth® wireless technology and uses the oscillometric method to calculate blood pressure non-invasively.

Without any wires or cables to trip you up, you and your students can now measure blood pressure anywhere you want. Simply attach the cuff to the subject and connect the sensor to a device running Graphical Analysis™ 4. Pump up the cuff and, as the cuff pressure decreases, the student's blood pressure parameters, including mean arterial blood pressure, systolic and diastolic blood pressure, and pulse rate, are automatically reported.

You can find free experiments for Go Direct Blood Pressure and sample data at **www.vernier.com/gdx-bp**

Instructing with Relevant, Real-World Applications: Evaluating Plastic Waste in the Environment

By Sara Tallarovic

Plastics in the environment are prominent in the news lately. As plastic waste finds its way into the environment, it seemingly turns up everywhere—from the deepest ocean trench to high mountain tops, and even in the digestive tracts of seabirds and marine mammals. Categorized by size, microplastics are pieces of plastic waste that are smaller than 0.5 cm in size. In contrast, mesoplastics are between 0.5 cm and 10 cm, and macroplastics are the largest at over 10 cm in size. Microplastics are currently in the spotlight, mainly because of their widespread distribution and potential impact on marine ecosystems, including fish nurseries.

If you live or teach near a coastline, it is easy to investigate this phenomenon with your students using our digital microscopes, such as the USB Digital Microscope and the 5 Megapixel Celestron® Digital Imager. Our samples from the beach revealed both primary microplastics (i.e., small pieces of plastic released directly into the environment) and secondary microplastics (i.e., particles that result from the breakdown of larger pieces). Depending on your time and resources, there are two collection methods that can be an effective way of finding plastics to examine with your students.

Learn more about this experiment at **www.vernier.com/r1912**

NEW Go Direct Sensor Clamp

The Go Direct Sensor Clamp is an accessory for wand-style Go Direct sensors that helps reduce the chances of accidental drops or submersion in water by students. Ideal for field work, the Sensor Clamp securely holds a sensor, such as Go Direct Optical Dissolved Oxygen, while using it to measure water quality parameters. Using the included lanyard, you can also hang Go Direct Temperature from a bush or tree to measure air temperature.

Learn more about Go Direct Clamp at **www.vernier.com/gdx-clamp**

Understanding Nernstian Behavior Using Ion-Selective Electrodes

Use Vernier ion-selective electrodes (ISE) in an innovative way to facilitate student understanding of Nernstian behavior. While most ISEs on the market allow you to report measurements as potential (in mV), with our Go Direct Ion-Selective Electrodes, you have the option to report readings in mg/L, mV, or both. Simultaneously displaying graphs of concentration and potential means students can visualize their data in new ways and develop a more complex understanding of Nerstian behavior.

ISEs give direct measurement of cations and anions. The electrode produces a difference in potential between itself and a reference electrode. This difference in potential is proportional to the concentration of the selected ion in solution and is described by the Nernst equation, making ISEs useful teaching tools. Go Direct ISEs from Vernier include the following species: NO_3^-, NH_4^+, Ca^{2+}, Cl^-, and K^+.

To learn more, visit **www.vernier.com/r1913**

Software Updates

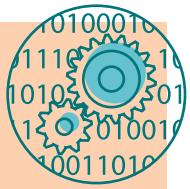
We regularly release software updates to support new sensors, add new features, and fix the occasional bug. Keeping up to date with software releases is one way to help things run smoothly in your classroom or lab. Have you updated your Vernier applications in the last few months? Updates are free, and with the release of new Go Direct sensors, we've updated nearly all our software.

For updates to Logger *Pro*® 3 for macOS® and Windows®, as well as for LabQuest® App, visit **www.vernier.com/downloads**

Graphical Analysis 4 on macOS and Windows detects the availability of an update and notifies you with a red dot on the overflow menu.

To update Chrome™, iOS, and Android™ applications, including Graphical Analysis 4 app, search the appropriate app store. Updates will eventually be applied automatically, but you can be sure of the current version by deleting and reinstalling the app.

Changes in macOS Catalina 10.15, to be released by Apple in the fall of 2019, will disable video analysis features in Logger *Pro*. Vernier plans to release an updated version of Logger *Pro* to restore video features in 2019. To avoid a temporary loss of functionality, macOS users who want to continue using video analysis features should delay updating to macOS 10.15 until Logger *Pro* has been updated.



Engineering Contest Now Accepting Entries

Are you using Vernier sensors to introduce engineering concepts or practices to your college students? If so, enter the Vernier Engineering Contest for the chance to win a $5,500 award.

For complete rules and to submit an online application and video showcasing your entry, visit **www.vernier.com/grants/engineering**

20 Years Ago in this Newsletter

Twenty years ago, we introduced the LabPro® interface. LabPro was created as a joint project between Vernier and Texas Instruments, and it was a huge hit—partly because it could work with either computers or TI calculators. (This was a time when computers were so expensive most schools could only afford very few.) We still support LabPro, and thousands of students are still using them 20 years later. Nearly all sensors made for LabPro can still be used today with our newer interfaces, such as LabQuest 2.

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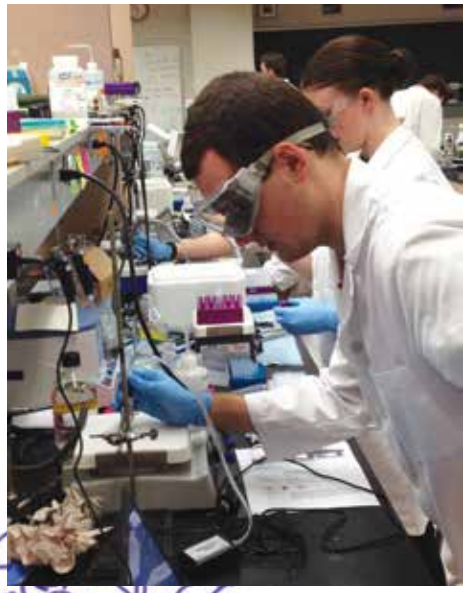

Genetic Code Expansion: Using Vernier in Undergraduate Research

By Kari van Zee

Over the last five years, the biochemistry faculty at Oregon State University have provided undergraduate students with the unique opportunity to participate in a 10-week, hypothesis-driven research experience related to genetic code expansion. This laboratory course helps promote the development of teamwork, communication, and advanced experimental planning skills in addition to chemical biology and biochemistry learning outcomes.

During the "Chemical Biology & Biochemistry Laboratory Using Genetic Code Expansion" course, teams of students design, synthesize, and evaluate the structure-function relationships of proteins containing non-standard amino acids by genetic code expansion. Central to the data-collection process is the use of Vernier sensors, including a spectrophotometer such as the Go Direct® SpectroVis® Plus and a gas pressure sensor such as a Go Direct Gas Pressure Sensor.

Read more about this program at **www.vernier.com/r1914**

Vernier in the Journals

Hundreds of institutions, such as Boston University, Portland State University, and more, use Vernier technology in their college courses.

Recent journals have featured Vernier technology in the following articles:

- "Effective and Inexpensive HPLC Analogue for First-Year Students: Buret Chromatography of Food Dyes in Drinks"
- "Escape the Lab: An Interactive Escape-Room Game as a Laboratory Experiment"
- "Sound Propagation, Reflection, and Its Relevance to Ultrasound Imaging"
- "What a Metal Pipe Can Teach You About Magnetism"

See the references and learn more about these uses at **www.vernier.com/r1915**